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USNEA HIRTA (L.) Hoffm. Likewise common but rather poorly developed.

USNEA PLICATA (L.) Weber. On trees throughout but not specially notable.

USNEA DASYPOGA (Ach.) Nyl. Neither abundant nor well developed, but found throughout on trees and fences.

BLASTENIA ATROSANGUINEA (Merrill) Herre. Not rare on *Acer circinatum* and occasional on other trees in the lowlands. Spores simple to bi- and polarilocular, 5–7 by 10–16μ.

CALOPLACA ELEGANS (Link) Th. Fr. Mt. Baker, on rocks at 5000 feet and upward.

CALOPLACA JUNGERMANNIAE (Vahl) Th. Fr. Found in tiny patches on mosses; Mt. Baker, 6000 feet.

XANTHORIA POLYCARPA (Ehrh.) Th. Fr. Abundant throughout the lower levels on fruit trees, fences, and twigs of various forest trees.

BUELLIA PARASEMA (Ach.) Th. Fr. Common on smooth barks in the lowlands.

BUELLIA ALIENA (Nyl.) Herre, var. PENICHRA (Tuck.) Herre. On bark of *Pseudotsuga mucronata*, Sumas Mt., at 1700 feet; spores 12.3–16 by 21–27μ.

BUELLIA ALBO-ATRA (Hoffm.) Th. Fr. Common on trunks of trees, especially Douglas spruce.

BUELLIA PAPILLATA (Sommerf.) Tuck. Overrunning dead mosses; Mt. Baker, 7000 feet.

I also have one or two additional species of rock Buellias which I have not yet satisfactorily determined.

RINODINA HALLII Tuck. On smooth barks in the lowlands.

RINODINA EXIGUA (Ach.) Th. Fr. Occasional with *Lecidea parasema*.

RINODINA TURFACEA (Wahl.) Nyl. In very tiny patches on mosses; Mt. Baker, 6000 feet, mixed with *Caloplaca jungermanniae*.

PHYSCIA AIPOLIA (Ach.) Nyl. On *Acer macrophyllum*, in the lowlands.

PHYSCIA TENELLA (Scop.) Nyl. Common on apple trees in the lowlands.

PHYSCIA PULVERULENTA (Schreb.) Nyl. Growing on moss on Mt. Baker at 6000 to 7000 feet; material sterile and small.

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NOTES ON NORTH AMERICAN SPHAGNUM:—VII.

A. LEROY ANDREWS

The Group Cuspidata Lindberg (Continued)

16. *Sphagnum recurvum* Beauvois, 1805. An earlier name, *S. intermedium* Hoffmann, 1795[1] has been used by some authors for this species, but its status is so uncertain[2] that it has been rather generally and probably justly abandoned.

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[1] Dr. Barnhart has called my attention to the fact that while the second volume of Deutschlands Flora was not published until 1796, a portion containing *Sphagnum* came out shortly before the close of 1795; cf. Hoppe, Botanisches Taschenbuch, 1796, 243ff.

[2] The whole question is discussed in considerable detail by Dusén in Sphagnaceernas utbredning, 42ff. 1887.

Even the name ***recurvum*** has been discarded by some recent authors, though hardly with equal justice. Beauvois' name is distinctive, the description emphasizing the distinctive feature, and his type-locality was South Carolina, which excludes other species with recurved leaf-apices and the several valid segregates, whose range does not in any case extend further south than New Jersey.

Some of its characters have been indicated in my last paper: the cortical cells of its stem are not strongly differentiated from those within, the stem-leaves are relatively small, the branch-leaves show when dry not only recurved tips, but also several undulations further down (a condition of things not evident when they are moist), their chlorophyll cells are exposed broadly on the dorsal surface, triangular in section with the apex ordinarily just about reaching the ventral surface, their pores are few, on the outer surface small end-pores usually at both ends of the cell with sometimes an additional pore or two in the lateral corners, on the inner surface a few rather large round pores in cell-corners, the latter rarely exceeding four to the cell, sometimes almost or entirely suppressed.[3] The plants are nearly always bright green, but may show a brownish pigmentation; the leaves of the antheridial catkins are strongly pigmented brown. Though dioicous the species fruits by no means rarely, fruiting tufts often showing male plants intermingled with those bearing the capsules.

Though the structure of this species is so relatively simple that one might be tempted (wrongly) to consider it the ancestral type of the order, it is in its formal variation the most difficult and critical species after *S. subsecundum*. Apart from the forms which can with a degree of justification be separated as varieties or species there remain several synonyms to be explained. *S. pulchricoma* Carl Müller, 1848 is now accredited by Warnstorf to North America.[4] It was based originally upon South American forms. I have not seen the type-specimen of *S. pulchricoma*, but have seen Brazilian specimens so named by Carl Müller together with various others from South America. These I should not feel entirely justified in separating specifically from *S. recurvum*. Warnstorf has included under *S. pulchricoma* not only specimens from our Gulf states, but also some from as far north as Massachusetts which are entirely normal *S. recurvum*. The characters that he gives for *S. pulchricoma*, lacerate stem-leaves and chlorophyll cells of the branch-leaves not reaching their ventral surface, do not apply to all the specimens named *S. pulchricoma* by Warnstorf himself, and in fact so far as they indicate a tendency at all indicate one within the normal lines of variation of the usual European and North American *S. recurvum*, except that the leaf-section of our most southern form is noteworthy. The character is however somewhat variable. Upon a specimen from Alabama Warnstorf based in 1908 a new *S. riparioides*, which he still (1911) retains. The type-material is in every way identical with other specimens included by Warnstorf in *S. pulchricoma*, in fact a quite similar specimen collected in the same locality by one of the same collectors was named *S. pulchricoma* by Warnstorf himself in 1906.

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[3] The relative lack of porosity of this and related species, in fact of the whole group *Cuspidata*, makes them of little value in the present important use for surgical dressings.

[4] Pflanzenreich, **51**: 188ff. 1911.

The question of *S. amblyphyllum* (Russow) H. Lindberg, 1903[5] is a more vexatious one and brings us at once into the whole problem of the close and still critical segregates of *S. recurvum.* The basis for the separation was furnished substantially by Russow, who proposed a division into four subspecies[6] which are by many European bryologists now treated as separate species. I am able to recognize *S. pulchrum* and *S. balticum* as distinct, though I have no quarrel with those who prefer to call them varieties, and will discuss them later; to the variety *tenue* I can not accord specific rank, and I will discuss it also later. With this the four-fold division of Russow would seem to be accounted for, but Warnstorf and others following him have made out of this a five-fold one. Russow gave a name to each separate form, leaving nothing under the species without subspecific name, his subspecies being *mucronatum*, *amblyphyllum*, *balticum* and *angustifolium.* The difference between the subspecies *mucronatum* and *amblyphyllum* (as interpreted by Warnstorf and others) lay almost exclusively in the triangular stem-leaves of *mucronatum* and the more lingulate ones with rounded or truncate apex of *amblyphyllum.* The variety *pulchrum* of Lindberg (1880) was included within the subspecies *mucronatum* by Russow, but was separated from it by Warnstorf as a fifth variety the same year.[7] In 1903 H. Lindberg definitively recognized all five forms as species, even discarding the old name *S. recurvum* as of uncertain application, discarding *mucronatum* because already used for a different species, and creating the new specific name *S. apiculatum* for this form.[8] Röll has on the other hand consistently refused to recognize *S. amblyphyllum* as a species distinct from *S. recurvum*, and Warnstorf had himself noted in 1891[9] that both kinds of stem-leaves can be found on the same stem, but now[10] attempts to meet the difficulty by suggesting examining the stem-leaves on slide without cover-glass. My observations on this point force me to agree with Röll. I have had no difficulty in finding *amblyphyllum* leaves on plants determined by Warnstorf as *mucronatum*, can find no other character whatever to correlate with this one and am obliged to conclude that the distinction is without taxonomic significance.

The close relationship between *S. recurvum* and *S. cuspidatum* will call for further comment when we reach the latter species. For the present *S. fallax* Klinggräff, 1880 demands attention, as Warnstorf in his last work[11] has accredited it to North America. It is an aquatic form of *S. recurvum*[12]; the differences are those one becomes familiar with in aquatic forms. The cortical cells however remain those of *S. recurvum*, tending to confirm one's impression that *S. cuspidatum* can not likewise be regarded as a mere aquatic form of *S. recurvum*.

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[5] In 1913 (North American Flora, XV, 16) I have erroneously accredited *S. amblyphyllum* as a specific name to Warnstorf (1911).

[6] Sphagnologische Studien, 99ff. 1890; this paper is generally cited as of 1889, but seems not to have been actually published before 1890 (in Sitz.-ber. Nat. Ges. Dorpat, IX) as Dr. Barnhart informs me; Jensen (De danske Sphagnum-Arter, 116) says he received his copy of the separate reprint on February 14, 1890.

[7] Bot. Gaz. XV, 218f. 1890.

[8] Lotos, LI, 127.

[9] Verh. d. bot. Ver. d. Prov. Brandenburg, XXXII, 217.

[10] Pflanzenreich, **51**: 243. 1911.

[11] Ibid., 252ff.

As to distribution, *S. recurvum* is widely spread over the three northern continents, and either itself or closely related species occur also in South America and Africa. In North America it is not to be found everywhere, but may be looked for generally north of the limits of glaciation, extending further southward in the eastern states to Florida and through the tier of Gulf states to Louisiana. In the Pacific coast region Washington seems to constitute the southern limit; in the Rocky Mountains, Colorado.

Var. *tenue* Klinggräff, 1872. This is the small leaved form of the species and probably deserves taxonomic recognition as differing so markedly in aspect from the more normal forms that it is likely to be confused with other species. The intergrading of forms is however such that I doubt if any two persons could agree just where to draw a dividing line in case of a large number of specimens, in fact I am not convinced that one person would draw it twice in exactly the same place. Russow recognized in the work already referred to that the subspecies contained two distinguishable series of forms, those with leaves clearly undulate (*undulata*), and those without this character (*imbricata*). Warnstorf in his revision of the group *Cuspidata*,[13] which it should be said owed a great deal to Russow, characterized them more in detail as the forms *Warnstorfii* Jensen and *tenue* (Klinggräff). I have in North American Flora (1913) tried to secure a definite line of separation and at the same time recognize what seems the most natural taxonomic grouping by restoring the undulate leaved forms to the species and keeping under the variety only those with imbricate leaves, retaining then the varietal name which both has priority and was originally used in this sense.

The unfortunate attempt to make a species out of this variety or of these various forms has led to considerable disagreement as to specific name. Röll insists that his *brevifolium* has priority. The publication of it upon which he bases his claim[14] suggests a *nomen nudum*, as Warnstorf asserts;[15] it does, however, refer back to a series of forms characterized in Flora LXIX, 184ff. 1886, some of which at any rate probably belong within our variety, though the *S. cuspidatum* var. *brevifolium* Lindberg, 1880 included in it and apparently giving it its name belongs according to Warnstorf to *S. balticum*. Warnstorf himself used a specific name *parvifolium* (1900) applied varietally by Sendtner, while Russow as we have seen published in 1890 Jensen's *angustifolium* as a subspecific name and Scandinavian bryologists still use this name as specific. In his last work Warnstorf has given up *S. parvifolium* as a species, and including it as a variety under *S. amblyphyllum* has felt obliged to put its specimens with triangular stem-leaves as a new analogous variety *parvulum* under *S. recurvum.* This procedure is, I think, indicative enough not only of the specific worthlessness of *S. parvifolium*, but also of that of *S. amblyphyllum* as distinct from *S. recurvum.*

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[12] Cf. H. Lindberg, Lotos, LI, 123. 1903; Loeske, Zur Morphologie und Systematik der Laubmoose, 50. 1910.

[13] Verh. d. bot. Ver. d. Provinz Brandenburg, XXXII, 220. 1891.

[14] Bot. Centralbl., XXXIX, 340. 1889.

[15] Pflanzenreich, **51:** 214f. 1911.

This form with non-undulate leaves is more characteristic of the southern and inland range of the species, while the small-leaved form with undulate leaves is frequent in the far north. It is possible that the Greenland specimens all belong to the latter and that I should not have included Greenland in the range of the variety *tenue.* Neither form appears south of the limits of glaciation, the var. *tenue*, as I have defined it, finding its southern limits in the states Pennsylvania, Michigan, Minnesota, Nebraska, Montana, Idaho, Washington, so far as known at present.

17. *Sphagnum pulchrum* (Lindberg) Warnstorf, 1900. The variety *pulchrum* of *S. recurvum* (*S. intermedium*) was accredited by Braithwaite[16] to Lindberg, and as a form stands out so clearly that it has not been subject to much misunderstanding, though one may in some cases be in doubt as to whether a certain specimen should be placed with it or with the parent species. It is usually a robust plant, tends to a fairly pronounced brown pigmentation, the branch-leaves are decidedly broader in proportion to their length with rather less conspicuous undulations, they may be arranged quite clearly in five ranks, the separate leaves appear shortly apiculate from the fact that they are so strongly involute at the immediate apex. In section they show chlorophyll cells whose apex does not reach the ventral surface of the leaf. The stem-leaves are regularly of stout structure with the same tendency to a short involute apiculus. The stem in section shows cortical cells much more clearly set off than in *S. recurvum*, though they are not over large and have fairly substantial walls; the stems are accordingly generally brown and brittle as compared with those of the parent species. Fruit is extremely rare. The species shows considerable variation as it grows in or out of the water or under other different conditions, but is fairly clearly recognizable through its varied forms. Its occurrence falls entirely within the limits of *S. recurvum*, but is much more restricted. With us it is known only in the coastal region from Labrador to New Jersey. In the latter state I should say from my observations in Ocean County that it is in that portion of the state the commonest species of *Sphagnum.* In Nova Scotia it seems to be also well represented. Its European range is northwestern, from Finland to the British Isles, and confined to regions essentially coastal. In Asia it has not been found and very likely does not occur, as it is also lacking in interior and western North America.

18. *Sphagnum balticum* Russow, 1890. This form had been distinguished by Russow with a varietal name *mollissimum* as early as 1865.[17] Though called by Russow in 1890 a subspecies, it was in the same year published by Jensen as a full-fledged species[18] ascribed to Russow as author. It is a soft compact-grow-

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[16] Sphagnaceae, 81. 1880.

[17] Beiträge zur Kenntniss der Torfmoose, 61.

[18] De danske Sphagnum-Arter, 100.

ing form tending to take on a snuff-colored pigmentation, and the branch-leaves are not so markedly undulate as is commonly the case with *S. recurvum.* The branch-leaves tend to be considerably more porose on the outer surface than in the parent species, the stem-leaves are relatively large, and broad in proportion to their length (lingulate), and the stem-cortex is differentiated off as in *S. pulchrum*, or even more distinctly so. The species is one of the far north, being known in North America from Greenland and Alaska.[19] The Alaskan collection was made by Trelease at Port Wells in 1899.[20] I have a bit of the material from the herbarium of the New York Botanical Garden, and would agree with Warnstorf in its identification. I have also seen a specimen from Greenland in the herbarium of the Copenhagen Botanical Museum which seems to represent the species. It was collected by Kruuse (not Krause, as Warnstorf has it) in 1902 in the Scoresby Sound region. In Europe it belongs primarily to the north, though Warnstorf reports it from as far south as the Alps. It has also been collected in Siberia.

Apparently next related to this species is *S. annulatum* H. Lindberg, 1898, described from Finland. It is of similar appearance, rather coarser and more robust and distinguished particularly by the astonishing development of pores in the branch-leaves, approximating in this respect *S. subsecundum* or *S. mendocinum.* H. Lindberg was led by minor variations to make two other species, *S. Jensenii* 1899 and *S. propinquum* 1903 out of his material. They have been reunited, I have no doubt correctly, by Warnstorf in 1911,[21] though under the name *S. Jensenii* which lacks priority. I refer to this species because there is every reason to expect that it will be found in extreme northern North America. In Europe it is confined to the far north; it is also known from Siberia.[22]

If I may revert for a moment to the group *Squarrosa*, it will be recalled that I was previously not able to include Pennsylvania in the list of states representing the southern limit of distribution of *S. teres.* At about the same time Dr. Jennings published its occurrence in that state[23] near Linesville in Crawford County, and has kindly sent me a specimen from this collection. The locality falls within the limits of glaciation. It would be of decided interest if data sufficient could be secured to show just where various species of *Sphagnum* reach their southern limit of distribution in Pennsylvania and in just what relation this limit stands to the limit of glaciation. The same is of course true of other states across the country.

ITHACA, N. Y.

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[19] Reports of Warnstorf (Pflanzenreich, **51**: 227. 1911) from Labrador and New Hampshire I cannot verify.

[20] Cf. Harriman Alaska Expedition, V, 332. 1904; Warnstorf mentions other collections from Alaska.

[21] Pflanzenreich, **51**: 199ff.

[22] Warnstorf's locality for Japan should be confirmed.

[23] Mosses of Western Pennsylvania, 33. 1913.